WHAT IS CLAIMED IS:

1. A transmitter for transmitting modulation symbols in a wireless communication system, comprising:

a plurality of transmit antennas for achieving transmit diversity; and

a transmission coding matrix generator for producing a plurality of symbol combinations with a plurality of input symbols to transmit the input symbols once from each transmit antenna at each time period, forming a transmission coding matrix with rows corresponding to transmission time periods and columns corresponding to transmit antennas from the symbol combinations, and outputting the symbol combinations to the transmit antennas at a plurality of times, the transmission coding matrix having at least two columns orthogonal to each other and the symbol combinations having as elements the input symbols, the inversions and conjugates of the symbols, and symbols obtained by rotating the phases of some of the symbols once by a predetermined phase value to maximize a diversity gain.

2. The transmitter of claim 1, wherein if the number of the transmit antennas is 4, the transmission coding matrix generator comprises:

an encoder for generating a transmission coding matrix with four rows and four columns from four input symbols, and the inversions and the conjugates of the four symbols; and

at least two phase rotators for selectively rotating the phases of symbols in at least two of the columns of the transmission coding matrix by the predetermined phase value.

3. The transmitter of claim 2, wherein the transmission coding matrix is one of

$$\begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix}$$

$$\begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

4. The transmitter of claim 2, wherein if the input symbols are BPSK (Binary Phase Shift Keying) symbols, the transmission coding matrix is

$$U_2 = \begin{pmatrix} s_1 & s_2 & js_3 & s_4 \\ -s_2^* & s_1^* & -js_4^* & s_3^* \\ -s_4^* & -s_3^* & js_2^* & s_1^* \\ s_3 & -s_4 & -js_1 & s_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

5. The transmitter of claim 2, wherein if the input symbols are QPSK (Quadrature Phase Shift Keying) symbols, the transmission coding matrix is

$$U_4 = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

6. The transmitter of claim 5, wherein v is $e^{-j2\pi/3}$.

7. The transmitter of claim 2, wherein if the input symbols are 8PSK (8-ary Phase Shift Keying) symbols, the transmission coding matrix is

$$U_6 = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

8. The transmitter of claim 7, wherein v is $e^{-j5\pi/6}$.

9. The transmitter of claim 2, wherein if the input symbols are 16QAM (16-ary Quadrature Amplitude Modulation) symbols, the transmission coding matrix is

$$U_8 = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

10. The transmitter of claim 9, wherein v is $e^{-j5\pi/12}$.

11. The transmitter of claim 2, wherein if the input symbols are 64QAM (64-ary Quadrature Amplitude Modulation) symbols, the transmission coding matrix is

$$U_{10} = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

12. The transmitter of claim 11, wherein v is $e^{-j7\pi/48}$.

13. The transmitter of claim 1, wherein if the number of the transmit antennas is 3, the transmission coding matrix generator comprises:

an encoder for generating a transmission coding matrix with four rows and four columns from four input symbols, and the inversions and the conjugates of the four symbols;

at least two phase rotators for selectively rotating the phases of symbols in at least two of the columns of the transmission coding matrix by the predetermined phase value; and

a column generator for generating a new column by summing the symbols of the selected two columns containing phase-rotated symbols and replacing the selected two columns with the new column, thereby generating a transmission coding matrix with four rows and three columns.

14. The transmitter of claim 13, wherein the transmission coding matrix generated from the encoder is one of

$$\begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix}$$

$$\begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

15. The transmitter of claim 13, wherein if the input symbols are BPSK symbols, the transmission coding matrix is

$$U_1 = \begin{pmatrix} s_1 & \frac{s_2 + js_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^* - js_4^*}{\sqrt{2}} & s_3^* \\ -s_4^* & \frac{-s_3^* + js_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4 - js_1}{\sqrt{2}} & s_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

16. The transmitter of claim 13, wherein if the input symbols are QPSK symbols, the transmission coding matrix is

$$U_3=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

17. The transmitter of claim 16, wherein v is $e^{-j2\pi/3}$.

18. The transmitter of claim 13, wherein if the input symbols are 8PSK symbols, the transmission coding matrix is

$$U_5=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

19. The transmitter of claim 18, wherein v is $e^{-j5\pi/6}$.

20. The transmitter of claim 13, wherein if the input symbols are 16QAM symbols, the transmission coding matrix is

$$U_7=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

21. The transmitter of claim 20, wherein v is $e^{-j5\pi/12}$.

22. The transmitter of claim 13, wherein if the input symbols are 64QAM symbols, the transmission coding matrix is

$$U_9=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

23. The transcriber of claim 22, wherein v is $e^{-j7\pi/48}$.

24. A receiver for receiving modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over all possible symbol pairs using signals received by a receive antenna from three transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna,

wherein if the modulation symbols are BPSK (Binary Phase Shift Keying) symbols, the first and second decoders compute parameters

$$R_1=\alpha^* r_1+\beta\frac{1}{\sqrt{2}}r_2^*+\gamma r_3^*+j\beta^*\frac{1}{\sqrt{2}}r_4$$

$$R_3=\gamma r_2^*-j\beta^*\frac{1}{\sqrt{2}}r_1+\alpha^* r_4-\beta^*\frac{1}{\sqrt{2}}r_3^*$$

$$R_{13}=\frac{j(C_1+C_3)}{2}$$

$$C_1=-\alpha^*\beta\sqrt{2}-\alpha\beta^*\sqrt{2}$$

$$C_3=j\gamma^*\beta\sqrt{2}-j\gamma\beta^*\sqrt{2}$$

$$R_2=\beta^*\frac{1}{\sqrt{2}}r_1-\alpha r_2^*+j\beta\frac{1}{\sqrt{2}}r_3^*+\gamma^* r_4$$

$$R_4=\gamma^* r_1-j\beta\frac{1}{\sqrt{2}}r_2^*-\alpha r_3^*-\beta^*\frac{1}{\sqrt{2}}r_4$$

$$R_{24}=\frac{j(C_2+C_4)}{2}$$

$$C_2=\alpha\beta^*\sqrt{2}+\alpha^*\beta\sqrt{2}$$

$$C_4=j\gamma\beta^*\sqrt{2}-j\gamma^*\beta\sqrt{2}$$

where α, β and γ are the channel gains and r1, r2, r3 and r4 are the received signals, and the first and second decoders find symbol pairs (x_1, x_3) and (x_2, x_4) that minimize $|\mathbf{R}_1 - \mathbf{x}_1|^2 + |\mathbf{R}_3 - \mathbf{x}_3|^2 + |\mathbf{R}_{13} - \mathbf{x}_1^*\mathbf{x}_3|^2$ and $|\mathbf{R}_2 - \mathbf{x}_2|^2 + |\mathbf{R}_4 - \mathbf{x}_4|^2 + |\mathbf{R}_{24} - \mathbf{x}_2^*\mathbf{x}_4|^2$, respectively.

25. A receiver for receiving modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over all possible symbol pairs using signals received by a receive antenna from three transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna,

wherein if the modulation symbols are QPSK (Quadrature Phase Shift Keying) or 8PSK (8-ary PSK) symbols, the first and second decoders compute parameters

$$R_1 = \alpha^* r_1 + \beta \frac{1}{\sqrt{2}} r_2^* + \gamma r_3^* - v^* \beta^* \frac{1}{\sqrt{2}} r_4$$

$$R_3 = v\gamma r_2^* + \beta^* \frac{1}{\sqrt{2}} r_1 + \alpha^* r_4 - \beta \frac{1}{\sqrt{2}} r_3^*$$

$$R_{13} = -\frac{(C_1 + C_3)}{2}$$

$$C_1 = -\alpha^* \beta v \sqrt{2} + \alpha \beta^* \sqrt{2}$$

$$C_3 = \gamma \beta^* v \sqrt{2} - \gamma^* \beta \sqrt{2}$$

$$R_2 = \beta^* \frac{1}{\sqrt{2}} r_1 - \alpha r_2^* + \beta \frac{1}{\sqrt{2}} r_3^* + v^* \gamma^* r_4$$

$$R_4 = \gamma^* r_1 - v\beta \frac{1}{\sqrt{2}} r_2^* - \alpha r_3^* - \beta^* \frac{1}{\sqrt{2}} r_4$$

$$R_{24}=-\frac{(C_2+C_4)}{2}$$

$$C_2=-\alpha\beta^*\sqrt{2}+v\alpha^*\beta\sqrt{2}$$

$$C_4=-v\gamma\beta^*\sqrt{2}+\gamma^*\beta\sqrt{2}$$

where α, β and γ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a phase value by which the transmitter rotates the phases of the symbols, and the first and second decoders find symbol pairs (x_1, x_3) and (x_2, x_4) that minimize $|\mathbf{R}_1-\mathbf{x}_1|^2+|\mathbf{R}_3-\mathbf{x}_3|^2+|\mathbf{R}_{13}-\mathbf{x}_1^*\mathbf{x}_3|^2$ and $|\mathbf{R}_2-\mathbf{x}_2|^2+|\mathbf{R}_4-\mathbf{x}_4|^2+|\mathbf{R}_{24}-\mathbf{x}_2^*\mathbf{x}_4|^2$, respectively.

26. A receiver for receiving modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over all possible symbol pairs using signals received by a receive antenna from three transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna,

wherein if the modulation symbols are 16QAM (16-ary Quadrature Amplitude Modulation) or 64QAM (64-ary QAM) symbols, the first and second decoders compute parameters

$$R_1=\frac{\left(\alpha^* r_1+\beta\frac{1}{\sqrt{2}}r_2^*+\gamma r_3^*-v^*\beta^*\frac{1}{\sqrt{2}}r_4\right)}{K_3}$$

$$R_3=\frac{\left(v\gamma r_2^*+\beta^*\frac{1}{\sqrt{2}}r_1+\alpha^* r_4-\beta\frac{1}{\sqrt{2}}r_3^*\right)}{K_3}$$

$$R_{13} = -\frac{(C_1 + C_3)}{2K_3}$$

$$K_3 = |\alpha|^2 + |\beta|^2 + |\gamma|^2$$

$$C_1 = -\alpha^* \beta v \sqrt{2} + \alpha \beta^* \sqrt{2}$$

$$C_3 = \gamma \beta^* v \sqrt{2} - \gamma^* \beta \sqrt{2}$$

$$R_2 = \frac{\left(\beta^* \frac{1}{\sqrt{2}} r_1 - \alpha r_2^* + \beta \frac{1}{\sqrt{2}} r_3^* + v^* \gamma^* r_4\right)}{K_3}$$

$$R_4 = \frac{\left(\gamma^* r_1 - v \beta \frac{1}{\sqrt{2}} r_2^* - \alpha r_3^* - \beta^* \frac{1}{\sqrt{2}} r_4\right)}{K_3}$$

$$R_{24} = -\frac{(C_2 + C_4)}{2K_3}$$

$$C_2 = -\alpha \beta^* \sqrt{2} + v \alpha^* \beta \sqrt{2}$$

$$C_4 = -v \gamma \beta^* \sqrt{2} + \gamma^* \beta \sqrt{2}$$

where α, β and γ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a phase value by which the transmitter rotates the phases of the symbols,

and the first and second decoders find symbol pairs (x_1, x_3) and (x_2, x_4) that minimize $|\mathbf{R}_1 - \mathbf{x}_1|^2 + |\mathbf{R}_3 - \mathbf{x}_3|^2 + |\mathbf{R}_{13} - \mathbf{x}_1^* \mathbf{x}_3|^2 - |\mathbf{x}_1|^2 |\mathbf{x}_3|^2$ and $|\mathbf{R}_2 - \mathbf{x}_2|^2 + |\mathbf{R}_4 - \mathbf{x}_4|^2 + |\mathbf{R}_{24} - \mathbf{x}_2^* \mathbf{x}_4|^2 - |\mathbf{x}_2|^2 |\mathbf{x}_4|^2$, respectively.

27. A receiver for receiving modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over all possible symbol pairs using

signals received by a receive antenna from four transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna,

wherein if the modulation symbols are BPSK (Binary Phase Shift Keying) symbols, the first and second decoders compute parameters

$$R_1 = \alpha^* r_1 + \beta r_2^* + \zeta r_3^* + j\gamma^* r_4$$

$$R_3 = \zeta r_2^* - j\gamma^* r_1 + \alpha^* r_4 - \beta r_3^*$$

$$R_{13} = -(C_1 + C_3)$$

$$C_1 = j\alpha^* \gamma + j\alpha\gamma^*$$

$$C_3 = \zeta^* \beta - \zeta\beta^*$$

$$R_2 = \beta^* r_1 - \alpha r_2^* + j\gamma r_3^* + \zeta^* r_4$$

$$R_4 = \zeta^* r_1 - j\gamma r_2^* - \alpha r_3^* - \beta^* r_4$$

$$R_{24} = -(C_2 + C_4)$$

$$C_2 = \zeta\beta^* - \zeta^* \beta$$

$$C_4 = -j\alpha\gamma^* - j\gamma\alpha^*$$

where α, β, γ and ξ are the channel gains and r1, r2, r3 and r4 are the received signals,

and the first and second decoders find symbol pairs (x_1, x_3) and (x_2, x_4) that minimize $|R_1 - x_1|^2 + |R_3 - x_3|^2 + |R_{13} - x_1{}^* x_3|^2$ and $|R_2 - x_2|^2 + |R_4 - x_4|^2 + |R_{24} - x_2{}^* x_4|^2$, respectively.

28. A receiver for receiving modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over all possible symbol pairs using

signals received by a receive antenna from four transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna,

wherein if the modulation symbols are QPSK (Quadrature Phase Shift Keying) or 8PSK (8-ary PSK) symbols, the first and second decoders compute parameters

$$R_1=\alpha^* r_1+\beta r_2^*+\zeta r_3^*-\nu^* \gamma^* r_4$$

$$R_3=\nu\zeta r_2^*+\gamma^* r_1+\alpha^* r_4-\beta r_3^*$$

$$R_{13}=-(C_1+C_3)$$

$$C_1=-\alpha^* \gamma\nu+\alpha\gamma^*$$

$$C_3=\zeta\beta^* \nu-\zeta^* \beta$$

$$R_2=\beta^* r_1-\alpha r_2^*+\gamma r_3^*+\nu^* \zeta^* r_4$$

$$R_4=\zeta^* r_1-\nu\gamma r_2^*-\alpha r_3^*-\beta^* r_4$$

$$R_{24}=-(C_2+C_4)$$

$$C_2=-\alpha\gamma^*+\nu\alpha^* \gamma$$

$$C_4=-\nu\zeta\beta^*+\zeta^* \beta$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a phase value by which the transmitter rotates the phases of the symbols, and the first and second decoders find symbol pairs (x_1, x_3) and (x_2, x_4) that minimize $|\mathbf{R}_1-\mathbf{x}_1|^2+|\mathbf{R}_3-\mathbf{x}_3|^2+|\mathbf{R}_{13}-\mathbf{x}_1^*\mathbf{x}_3|^2$ and $|\mathbf{R}_2-\mathbf{x}_2|^2+|\mathbf{R}_4-\mathbf{x}_4|^2+|\mathbf{R}_{24}-\mathbf{x}_2^*\mathbf{x}_4|^2$, respectively.

29. A receiver for receiving modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over all possible symbol pairs using signals received by a receive antenna from four transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna,

wherein if the modulation symbols are 16QAM (16-ary Quadrature Amplitude Modulation) or 64QAM (64-ary QAM) symbols, the first and second decoders compute parameters

$$R_1=\frac{(\alpha^* r_1+\beta r_2^*+\zeta r_3^*-\nu^*\gamma^* r_4)}{K_4}$$

$$R_3=\frac{(\nu\zeta r_2^*+\gamma^* r_1+\alpha^* r_4-\beta r_3^*)}{K_4}$$

$$R_{13}=-\frac{(C_1+C_3)}{K_4}$$

$$K_4=|\alpha|^2+|\beta|^2+|\gamma|^2$$

$$C_1=-\alpha^*\gamma\nu+\alpha\gamma^*$$

$$C_3=\zeta\beta^*\nu-\zeta^*\beta$$

$$R_2=\frac{(\beta^* r_1-\alpha r_2^*+\gamma r_3^*+\nu^*\zeta^* r_4)}{K_4}$$

$$R_4=\frac{(\zeta^* r_1-\nu\gamma r_2^*-\alpha r_3^*-\beta^* r_4)}{K_4}$$

$$R_{24}=-\frac{(C_2+C_4)}{K_4}$$

$$C_2=-\alpha\gamma^*+\nu\alpha^*\gamma$$

$$C_4=-\nu\zeta\beta^*+\zeta^*\beta$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals,

and v is a phase value by which the transmitter rotates the phases of the symbols, and the first and second decoders find symbol pairs (x_1, x_3) and (x_2, x_4) that minimize $|\mathbf{R}_1 - \mathbf{x}_1|^2 + |\mathbf{R}_3 - \mathbf{x}_3|^2 + |\mathbf{R}_{13} - \mathbf{x}_1^*\mathbf{x}_3|^2 - |\mathbf{x}_1|^2|\mathbf{x}_3|^2$ and $|\mathbf{R}_2 - \mathbf{x}_2|^2 + |\mathbf{R}_4 - \mathbf{x}_4|^2 + |\mathbf{R}_{24} - \mathbf{x}_2^*\mathbf{x}_4|^2 - |\mathbf{x}_2|^2|\mathbf{x}_4|^2$, respectively.

30. A receiver for receiving PSK (Phase Shift Keying) modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for selecting candidate symbol pairs among all possible symbol pairs using signals received by a receive antenna from three transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna, and detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over the candidate symbol pairs,

wherein the first and second decoders compute parameters

$$R_1=\alpha^* r_1+\beta\frac{1}{\sqrt{2}} r_2^*+\gamma r_3^*-v^*\beta^*\frac{1}{\sqrt{2}} r_4$$

$$R_3=v\gamma r_2^*+\beta^*\frac{1}{\sqrt{2}} r_1+\alpha^* r_4-\beta\frac{1}{\sqrt{2}} r_3^*$$

$$R_{13}=-\frac{(C_1+C_3)}{2}$$

$$C_1=-\alpha^*\beta v\sqrt{2}+\alpha\beta^*\sqrt{2}$$

$$C_3=\gamma\beta^* v\sqrt{2}-\gamma^*\beta\sqrt{2}$$

$$R_2=\beta^*\frac{1}{\sqrt{2}} r_1-\alpha r_2^*+\beta\frac{1}{\sqrt{2}} r_3^*+v^*\gamma^* r_4$$

$$R_4=\gamma^* r_1-v\beta\frac{1}{\sqrt{2}} r_2^*-\alpha r_3^*-\beta^*\frac{1}{\sqrt{2}} r_4$$

$$R_{24}=-\frac{(C_2+C_4)}{2}$$

$$C_2=-\alpha\beta^*\sqrt{2}+\nu\alpha^*\beta\sqrt{2}$$

$$C_4=-\nu\gamma\beta^*\sqrt{2}+\gamma^*\beta\sqrt{2}$$

where α, β and γ are the channel gains and r1, r2, r3 and r4 are the received signals, and the first and second decoders find all possible symbol pairs (x_1, x_3) and (x_2, x_4) as the candidate symbol pairs, symbols x_3 and x_4 being constellation points closest to $R_3+x_1R_{13}$ and $R_4+x_2R_{24}$, respectively.

31. A receiver for receiving QAM (Quadrature Amplitude Modulation) modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for selecting candidate symbol pairs among all possible symbol pairs using signals received by a receive antenna from three transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna, and detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over the candidate symbol pairs,

wherein the first and second decoders compute parameters

$$R_1=\frac{\left(\alpha^* r_1+\beta\frac{1}{\sqrt{2}}r_2^*+\gamma r_3^*-\nu^*\beta^*\frac{1}{\sqrt{2}}r_4\right)}{K_3}$$

$$R_3=\frac{\left(\nu\gamma r_2^*+\beta^*\frac{1}{\sqrt{2}}r_1+\alpha^* r_4-\beta\frac{1}{\sqrt{2}}r_3^*\right)}{K_3}$$

$$R_{13}=-\frac{(C_1+C_3)}{2K_3}$$

$$K_3=|\alpha|^2+|\beta|^2+|\gamma|^2$$

$$C_1=-\alpha^*\beta v\sqrt{2}+\alpha\beta^*\sqrt{2}$$

$$C_3=\gamma\beta^* v\sqrt{2}-\gamma^*\beta\sqrt{2}$$

$$R_2=\frac{\left(\beta^*\frac{1}{\sqrt{2}}r_1-\alpha r_2^*+\beta\frac{1}{\sqrt{2}}r_3^*+v^*\gamma^* r_4\right)}{K_3}$$

$$R_4=\frac{\left(\gamma^* r_1-v\beta\frac{1}{\sqrt{2}}r_2^*-\alpha r_3^*-\beta^*\frac{1}{\sqrt{2}}r_4\right)}{K_3}$$

$$R_{24}=-\frac{(C_2+C_4)}{2K_3}$$

$$C_2=-\alpha\beta^*\sqrt{2}+v\alpha^*\beta\sqrt{2}$$

$$C_4=-v\gamma\beta^*\sqrt{2}+\gamma^*\beta\sqrt{2}$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a phase value by which the transmitter rotates the phases of the symbols, and the first and second decoders find all possible symbol pairs (x_1, x_3) and (x_2, x_4) as the candidate symbol pairs, symbols x_3 and x_4 being the constellation points closest to $R_3+x_1R_{13}$ and $R_4+x_2R_{24}$, respectively.

32. A receiver for receiving PSK (Phase Shift Keying) modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for selecting candidate symbol pairs among all possible symbol pairs using signals received by a receive antenna from four transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna, and detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over the candidate symbol pairs,

wherein the first and second decoders compute parameters

$$R_1=\alpha^* r_1+\beta r_2^*+\zeta r_3^*-v^*\gamma^* r_4$$

$$R_3=v\zeta r_2^*+\gamma^* r_1+\alpha^* r_4-\beta r_3^*$$

$$R_{13}=-(C_1+C_3)$$

$$C_1=-\alpha^*\gamma v+\alpha\gamma^*$$

$$C_3=\zeta\beta^* v-\zeta^*\beta$$

$$R_2=\beta^* r_1-\alpha r_2^*+\gamma r_3^*+v^*\zeta^* r_4$$

$$R_4=\zeta^* r_1-v\gamma r_2^*-\alpha r_3^*-\beta^* r_4$$

$$R_{24}=-(C_2+C_4)$$

$$C_2=-\alpha\gamma^*+v\alpha^*\gamma$$

$$C_4=-v\zeta\beta^*+\zeta^*\beta$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a phase value by which the transmitter rotates the phases of the symbols, and the first and second decoders find all possible symbol pairs (x_1, x_3) and (x_2, x_4) as the candidate symbol pairs, symbols x_3 and x_4 being the constellation points closest to $R_3+x_1R_{13}$ and $R_4+x_2R_{24}$, respectively.

33. A receiver for receiving QAM (Quadrature Amplitude Modulation) modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for selecting candidate symbol pairs among all possible symbol pairs using signals received by a receive antenna from four transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna, and detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over the candidate symbol pairs,

wherein the first and second decoders compute parameters

$$R_1=\frac{(\alpha^* r_1+\beta r_2^*+\zeta r_3^*-v^*\gamma^* r_4)}{K_4}$$

$$R_3=\frac{(v\zeta r_2^*+\gamma^* r_1+\alpha^* r_4-\beta r_3^*)}{K_4}$$

$$R_{13}=-\frac{(C_1+C_3)}{K_4}$$

$$K_4=|\alpha|^2+|\beta|^2+|\gamma|^2$$

$$C_1=-\alpha^*\gamma v+\alpha\gamma^*$$

$$C_3=\zeta\beta^* v-\zeta^*\beta$$

$$R_2=\frac{(\beta^* r_1-\alpha r_2^*+\gamma r_3^*+v^*\zeta^* r_4)}{K_4}$$

$$R_4=\frac{(\zeta^* r_1-v\gamma r_2^*-\alpha r_3^*-\beta^* r_4)}{K_4}$$

$$R_{24}=-\frac{(C_2+C_4)}{K_4}$$

$$C_2=-\alpha\gamma^*+v\alpha^*\gamma$$

$$C_4=-v\zeta\beta^*+\zeta^*\beta$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a phase value by which the transmitter rotates the phases of the symbols, and the first and second decoders find all possible symbol pairs (x_1, x_3) and (x_2, x_4) as the candidate symbol pairs, symbols x_3 and x_4 being the constellation points closest to $R_3+x_1R_{13}$ and $R_4+x_2R_{24}$, respectively.

34. A receiver for receiving PSK (Phase Shift Keying) modulation

symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for selecting candidate symbol pairs among all possible symbol pairs using signals received by a receive antenna from three transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna, and detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over the candidate symbol pairs,

wherein the first decoder computes

$$R_1=\alpha^* r_1+\beta\frac{1}{\sqrt{2}} r_2^*+\gamma r_3^*-v^*\beta^*\frac{1}{\sqrt{2}} r_4$$

$$R_3=v\gamma r_2^*+\beta^*\frac{1}{\sqrt{2}} r_1+\alpha^* r_4-\beta\frac{1}{\sqrt{2}} r_3^*$$

$$R_{13}=-\frac{(C_1+C_3)}{2}$$

$$C_1=-\alpha^*\beta v\sqrt{2}+\alpha\beta^*\sqrt{2}$$

$$C_3=\gamma\beta^* v\sqrt{2}-\gamma^*\beta\sqrt{2}$$

where α, β and γ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a predetermined phase value by which the transmitter rotates the phases of the symbols,

outputs a symbol pair (x_1, x_3) if $x_1^* x_3=x_{13}$, x_1 being the closest symbol to R_1, x_3 being the closest symbol to R_3, and x_{13} being the closest symbol to R_{13}, and if $x_1^* x_3 \neq x_{13}$, computes an angle Φ_d by dividing the angle between x_{13} and $x_1^* x_3$ by 2 and selects symbols whose angles are within Φ_d from x_1 and x_3, respectively, as the candidate symbols,

and the second decoder computes

$$R_2=\beta^*\frac{1}{\sqrt{2}} r_1-\alpha r_2^*+\beta\frac{1}{\sqrt{2}} r_3^*+v^*\gamma^* r_4$$

$$R_4=\gamma^* r_1-\nu\beta\frac{1}{\sqrt{2}}r_2^*-\alpha r_3^*-\beta^*\frac{1}{\sqrt{2}}r_4$$

$$R_{24}=-\frac{(C_2+C_4)}{2}$$

$$C_2=-\alpha\beta^*\sqrt{2}+\nu\alpha^*\beta\sqrt{2}$$

$$C_4=-\nu\gamma\beta^*\sqrt{2}+\gamma^*\beta\sqrt{2}$$

where α, β and γ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is the predetermined phase value by which the transmitter rotates the phases of the symbols,

outputs a symbol pair (x_2, x_4) if $x_2^* x_4 = x_{24}$, x_2 being the closest symbol to R_2, x_4 being the closest symbol to R_4, and x_{24} being the closest symbol to R_{24}, and if $x_2^* x_4 \neq x_{13}$, computes an angle Φ_d' by dividing the angle between x_{24} and $x_2^* x_4$ by 2 and selects symbols whose angles are within Φ_d' from x_2 and x_4, respectively, as the candidate symbols.

35. A receiver for receiving PSK (Phase Shift Keying) modulation symbols whose phases are rotated once from a transmitter in a wireless communication system, comprising:

first and second decoders for selecting candidate symbol pairs among all possible symbol pairs using signals received by a receive antenna from four transmit antennas for four time periods and channel gains from the transmit antennas to the receive antenna, and detecting symbol pairs that minimize maximum likelihood (ML) decoding metrics over the candidate symbol pairs,

wherein the first decoder computes

$$R_1=\alpha^* r_1+\beta r_2^*+\zeta r_3^*-\nu^* \gamma^* r_4$$

$$R_3=\nu\zeta r_2^*+\gamma^* r_1+\alpha^* r_4-\beta r_3^*$$

$$R_{13}=-(C_1+C_3)$$

$$C_1=-\alpha^*\gamma\nu+\alpha\gamma^*$$

$$C_3=\zeta\beta^*\nu-\zeta^*\beta$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is a predetermined phase value by which the transmitter rotates the phases of the symbols, .

outputs a symbol pair (x_1, x_3) if $x_1^* x_3=x_{13}$, x_1 being the closest symbol to R_1, x_3 being the closest symbol to R_3, and x_{13} being the closest symbol to R_{13}, and if $x_1^* x_3 \neq x_{13}$, computes an angle Φ_d by dividing the angle between x_{13} and $x_1^* x_3$ by 2 and selects symbols whose angles are within Φ_d from x_1 and x_3, respectively, as the candidate symbols,

and the second decoder computes

$$R_2=\beta^* r_1-\alpha r_2^*+\gamma r_3^*+\nu^*\zeta^* r_4$$

$$R_4=\zeta^* r_1-\nu\gamma r_2^*-\alpha r_3^*-\beta^* r_4$$

$$R_{24}=-(C_2+C_4)$$

$$C_2=-\alpha\gamma^*+\nu\alpha^*\gamma$$

$$C_4=-\nu\zeta\beta^*+\zeta^*\beta$$

where α, β, γ and ξ are the channel gains, r1, r2, r3 and r4 are the received signals, and v is the predetermined phase value by which the transmitter rotates the phases of the symbols,

outputs a symbol pair (x_2, x_4) if $x_2^* x_4=x_{24}$, x_2 being the closest symbol to R_2, x_4 being the closest symbol to R_4, and x_{24} being the closest symbol to R_{24}, and if $x_2^* x_4 \neq x_{13}$, computes an angle Φ_d' by dividing the angle between x_{24} and $x_2^* x_4$ by 2 and selects symbols whose angles are within Φ_d' from x_2 and x_4, respectively as the candidate symbols.